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ABSTRACT

The document presents unit plans which offer lists of experiences and competencies to be learned in the area of materials handling and structuring for agribusiness, natural resources, and environmental occupations. The units include: (1) farmstead planning and reorganization; (2) site preparation (contour, terraces, waterways; land measurements and leveling; titling and ditching; and equipment service center); (3) building layout; (4) flat concrete; (5) concrete block; (6) structural materials and terminology (lumber patterns and wood building materials, wood adhesives, plywood, and building framing); (7) rafter layout and roof nomenclature (roofing and rafters and trusses); (8) building construction procedures; (9) environmental control; (10) electrical principles (electric principles and electrical wiring); (11) electrical motors and controls; (12) pumps and plumbing materials (water systems and plumbing); (13) waste disposal; and (14) materials handling systems. The number of hours required for each unit are given. (EC)

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MATERIALS HANDLING AND STRUCTURES

01.0302

For

Agribusiness, Natural Resources, and Environmental Occupations

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MATERIALS HANDLING AND STRUCTURES 01.0302

For

Agribusiness, Natural Resources, and Environmental Occupations

Occupational experiences provided are related to:

	D.O.T. Title	D.O.T. Code
1.	Farm operators	421.181-010
2.	Cement-mason helper	844.887-014
3.	Plumber	862.381-074
4.	Salesman	262.358-014
5.	Roofer helper	886.887-010
6.	Fence erector	869.684-030
7.	Farm forman	429.131-010
8.	Farm caretaker	421.131-010
9.	Maintenance man, building	889.381-010
10.	Carpenter helper, maintenance	860.887-010

General course competencies to accomplish:

1. Plan and reorganize farmsteads.
2. Maintain and remodel existing farmstead buildings.
3. Estimate cost of remodeling and maintaining existing buildings and new construction additions.
4. Select proper materials for the particular application.
5. Select proper tools and equipment for the job.
6. Use proper techniques and care in using the tools and equipment.
7. Perform work in a manner that is safe to himself, others and the equipment in use.
8. Pride in quality of workmanship.
9. To explain the principles of electricity and its application to electric motors and controls.

TABLE OF CONTENTS

Unit #	Topic	Hours	Page
I.	Farmstead Planning and Reorganization	7	1
II.	Site Preparation A. Contour, terraces and Waterways B. Land Measurement and Leveling C. Tiling and Ditching D. Equipment Service Center	19	2
III.	Building Layout	5	5
IV.	Flat Concrete	9	6
V.	Concrete Block	5	7
VI.	Structural Materials and Terminology A. Lumber Patterns & Building Materials B. Wood Adhesives C. Plywood D. Building Training	15	8
VII.	Rafter Layout and Roof Nomenclature A. Roofing B. Rafters and Trusses	20	11
VIII.	Building Construction Procedures	35	13
IX.	Environment Control	5	13
X.	Electrical Principles and Wiring A. Principles B. Wiring	12	14
XI.	Electrical Motors and Controls A. Motors B. Controls	15	16
XII.	Pumps and Plumbing Materials A. Water Systems B. Plumbing	18	18
XIII.	Waste Disposal	5	20
XIV.	Material Handling Systems	10	21
		180	

UNIT I FARMSTEAD PLANNING AND REORGANIZATION COMPETENCIES:

A. Draw and design plan for farmstead layout.
B. Plan and choose alternatives in farm building structures with emphasis on individual enterprises (grain, livestock, shop).
C. Plan and carry out shelterbelt placement and material choice.

A FARMSTEAD PLANNING AND REORGANIZATION ACTIVITIES TO PERFORM (7 hours) -- Ability to . . .

LESSON 1. Field trips to an efficient, well-planned farmstead layout in the community -- 1 hour
a. Observe the placement of buildings.
b. Select the farmstead planning guides that will result in saving space and time when applied to efficient farmstead building arrangement.
c. Draw a plan to scale depicting good farmstead planning.

LESSON 2. Farm building layout -- 1 hour
a. List the proper locations of buildings in proximity to one another.
b. List the principle guidelines to be followed whenever a farmstead building site is to be planned or constructed.

LESSON 3. Landscaping of the farm -- 1 hour
a. Identify the importance of good landscaping to a farm.
b. Select type of landscaping for home farm.

LESSON 4. Planning a shelterbelt -- 1 hour
a. List the considerations in planning a shelterbelt.
b. Locate shelter on own farm.
c. Recognize proper land preparation.
d. Discuss the proper time of year to plant.
e. List the tree types and their correct spacing.

LESSON 5 Tree selection -- 1 hour
a. Identify trees as in a shelter belt.
b. List recommended varieties of trees used in relation to soil and climatic conditions.
c. List government support programs for wind breaks.

LESSON 6. Planting and care of shelterbelt -- 1 hour
a. List methods of planting.
b. Plant by hand and by mechanical planter.
c. Discuss proper chemical weed control.
d. Select and apply chemical for weed control.

LESSON 7. Proper Management -- 1 hour
a. Discuss good forestry management.
b. Recognize high grade trees.
c. Discuss location, spacing, time and type of trees to plant.
d. Determine where and when to plant trees.
e. Discuss methods of harvesting timber-clear, seed tree, diameter limit and selective cutting of trees.
f. List procedures used in harvesting trees.

UNIT II. SITE PREPARATION COMPETENCIES INCLUDING:

A. Contour terraces waterways
B. Land leveling and land measurement
C. Tiling and ditching
   1. Setup and operate levels.
   2. Read rod.
   3. Determine slope.
   4. Determine soil texture and bearing capacity.
   5. Layout contour line.
   6. Measure area and calculate runoff.
   7. Determine tile sizes and capacities.

A. CONTOUR, TERRACES AND WATERWAYS (5 hours) -- Ability to . . .

LESSON 1. Contour lines -- 2 hours
   a. List the purposes of contour lines.
   b. Discuss proper setting of a contour line.
   c. Layout a contour line with a small hand instrument.

LESSON 2.
   a. Discuss different uses of contours on types of slopes.
   b. Observe how contour strips are plowed, planted, cultivated and harvested.
   c. Discuss how correct width of a contour strip is determined.
   d. Determine the acreage in a contour strip.

LESSON 3. Terraces -- 1 hour
   a. List the advantages of different types of terraces.
   b. Discuss different types, construction and design, location and spacing of terraces.
   c. How terraced land should be cropped and maintained.
   d. Sketch a terrace.

LESSON 4 Waterways -- 1 hour
   a. Discuss where and when waterways should be used.
   b. Discuss how grass waterways are established and maintained.

LESSON 5. Dams -- 1 hour
   a. List different purposes of dams.
   b. Draw plan of home farm and how they would use these practices on their farm.

B. LAND MEASUREMENTS AND LEVELING (7 hours) -- Ability to . . .

LESSON 1. Pacing, determining land area and instrument set-up -- 1 hour
   a. Pace to determine an assigned land area.
   b. Set-up tripod and instrument.
   c. List procedures used in care of surveying equipment.
   d. Check instrument for accuracy.

LESSON 2. Measuring distance and angles -- 1 hour
a. Read distances and angles on assigned area.

LESSON 3. Field trip -- 1 hour
a. Measure assigned areas
b. Measure with pace, wheel and chain.

LESSON 4. Determining elevation and percent slope -- 1 hour
a. Discuss the importance of knowing fall and slope.
b. Use level to determine elevation.
c. Use level to determine percent slope.

LESSON 5. Laying out a contour line -- 1 hour
a. To layout a contour line.
b. Use contour lines for terraces, contours and contour strips.
c. Layout waterways.

LESSON 6. Read aerial view maps -- 1 hour
a. Locate student's farms.
b. Make proper utilization of key students for your farm or area.

LESSON 7. Site Preparation and Determination of Grades -- 1 hour
a. To layout and square a building.
b. Discuss the necessity for level foundation.
c. Check the level of a building.
d. Explain why these should be sloped away from the building.

C. TILING AND DITCHING (2 hours) -- Ability to . . .

LESSON 1. Selection, location and spacing of tile or ditch -- 1 hour
a. Determine proper sizes for different soils.
b. Define tile types and application.
c. Determine location for best service.
d. Discuss proper depth for tile drains.
e. Discuss proper grades for tile drains.

LESSON 2. Construction and maintenance of tile drains -- 1 hour
a. List different digging methods for trenches.
b. Discuss proper laying of tile.
c. List steps used to protect the outlet.

D. EQUIPMENT SERVICE CENTER (5 hours) -- Ability to . . .

LESSON 1. Accident causing conditions -- 1 hour
a. List the more common causes of accidents in farm shops.
b. Develop a check list of inventory of safety factors to be used in rating his service center at home.
c. List possible safety hazards.

LESSON 2. Proper color coding and non-skid floor abrasives -- 1 hour
a. Discuss the safety color code and areas in shop where to apply non-skid.
b. Apply color coding and non-skid in the home farm shop.
c. Tour the color coded shop and explain areas.

LESSON 3. Planning the equipment service center -- 1 hour
- a. Determine the types of facilities desired.
- b. Determine size of different areas.
- c. Sketch the floor plan for a building.

LESSON 4. Selection of tools and equipment -- 1 hour
- a. Recognize tools and equipment.
- b. The capabilities of tools and equipment.
- c. To write tool specifications.
- d. Prepare a tool and equipment list.

LESSON 5. Selection of supplies -- 1 hour
- a. Select supplies most frequently needed.
- b. Order hardware, lumber and other building materials.
- c. Prepare list of supplies needed.

UNIT III. BUILDING LAYOUT COMPETENCIES

A. Square a building using diagonal measure method.
B. Erect batter boards.
C. Erect square, brace, and level forms.
D. Methods of anchoring poles.
E. Recognizing quality in concrete footing and foundation construction.

A. BUILDING LAYOUT LESSON (5 hours) -- Ability to . . .

LESSON 1. Squaring a building -- 1 hour
a. Discuss and demonstrate geometric calculations of traingulation.
b. Work with movable rectangle frames to demonstrate squaring principles.

LESSON 2 Batter board erection -- 1 hour
a. Discuss purposes.
b. Construct, level and square batter boards in groups of three.

LESSON 3. Concrete forms -- 1 hour
a. Determine bearing capacity of forms and footing size.
b. Demonstrate form strength using sand and water with plywood.
c. Demonstrate snap ties,
d. Actual construct forms.
(1) Proper bracing
(2) Level square form

LESSON 4. Anchoring poles -- 1 hour
a. Discuss methods of anchoring poles for pole sheds.
b. Wind effects and pole anchors.

LESSON 5. Footing and foundation depths -- 1 hour
a. Discuss foundations vs. slabs.
b. Discuss effect of frost pressures.
c. Discuss rodent proofing a slab.

UNIT VI. FLAT CONCRETE COMPETENCIES

A. Select good quality concrete products.
B. To use good techniques in curing concrete.
C. To use good techniques in finishing concrete.
D. Use of pipe and grade staker for leveling.
E. Estimating quantities and qualities in ordering ready mix concrete.
F. Understand the need for reinforcement.
G. Prepare base material requirements.

A. FLAT CONCRETE (9 hours) -- Ability to . . .

LESSON 1. Selection of aggregates for concrete -- 1 hour
a. Discuss the importance of aggregates in quality concrete.
b. Perform silt and organic matter test to determine quality concrete.

LESSON 2. Air entrained concrete -- 1 hour
a. List the advantages and disadvantages of air entrained concrete.
b. Determine percentage of air entrainment desired by use of an entraining test.

LESSON 3 Selection and design of concrete mixtures -- 1 hour
a. List the procedures used when designing a concrete mixture.
b. Design a concrete mixture.

LESSON 4 Job mixing concrete -- 1 hour
a. List the necessary steps for obtaining quality concrete when mixing is done on the job.
b. Run a slump test.

LESSON 5. Placing concrete -- 1 hour
a. List concrete placing procedures.
b. Properly place concrete in a hog trough or drain splash block using a vibrator.

LESSON 6. Finishing concrete slabs -- 1 hour
a. List the procedures for finishing concrete.
b. Properly finish the slab with a trowel.

LESSON 7. Reinforcement for concrete -- 1 hour
a. Discuss reasons reinforcement is used and how it is placed in concrete.
b. Properly reinforce a concrete slab.

LESSON 8. Curing concrete -- 1 hour
a. List the procedures for finishing concrete.
b. Cure concrete in a freezer, at a room temperature (dry) and in a tank of water (wet) and then test at different time intervals.

LESSON 9. Different designs in concrete -- 1 hour
a. List the different ways of coloring concrete.
b. List the different types of finishes used in concrete construction.

UNIT V. CONCRETE BLOCK COMPETENCIES

A. Select quality block type for intended job.
B. Mix good mortar with desirable properties.
C. Cut block.
D. Lay block and properly construct corner.
E. Properly place anchor bolts.

A. CONCRETE BLOCK (5 hours) -- Ability to . . .

LESSON 1. Concrete block manufacturing -- 1 hour
a. List three materials used in making blocks.
b. Discuss the difference between heavy-weight and light-weight blocks.
c. Tour a block manufacturing plant.

LESSON 2. Mortar for concrete block construction -- 1/2 hour
a. Recognize the desirable properties of good mortar.
b. Mix a small batch of mortar.

LESSON 3. Laying block corners -- 1 hour
a. Construct a corner properly.

LESSON 4. Laying concrete block walls -- 1 hour
a. Lay block.

LESSON 5. Concrete masonry wall finishes; painting, water painting and waterproofing -- 1/2 hour
a. Determine the need for waterproofing.
b. Determine the need and procedure of painting blocks.

LESSON 6. Construction details; insulation and ventilation -- 1 hour
a. Discuss how a properly constructed building is insulated and ventilated to keep it dry.
b. List different types of insulation materials.
c. Tour a block building with good ventilation and insulation.

UNIT VI. STRUCTURAL MATERIALS AND TERMINOLOGY COMPETENCIES

A. Understand terminology.
B. Understand forces, weights and loads.
C. Understand commercial grades and standards for building materials.
D. Understand material strength.
E. Figure quantities of material and calculating cost.
F. Selection of proper fasteners for the types of jobs (nails, hinges, glues, metal clamps, screws, bolts, and split ring clamp)
G. Lay out top and bottom plates when framing a building.
H. Properly header out doors and windows.
I. Properly reinforce corners for support.

A. LUMBER PATTERNS AND WOOD BUILDING MATERIALS (75 hours) -- Ability to . . .

LESSON 1. Types of materials -- 1 hour
a. Discuss different types of lumber patterns.
b. Different types of hard boards.
c. Determine varieties of wood.

LESSON 2 & 3. Grades of lumber and figuring board feet -- 2 hours
a. Discuss the difference in grades of lumber and hardboards.
b. Figure board foot and square foot.
c. Figure board feet.

LESSON 4. Types of nails and hardware -- 1 hour
a. Discuss the different types of nails, screw bolts, hinges, tacks, ect.
b. Distinguish between different nails, screws, etc.
c. Order hardware items properly.
d. Show examples of all the different types of hardware available.

LESSON 5. List of materials -- 1/2 hour
a. The requirement of a job.
b. Estimate type and amount of materials.

LESSON 6. Types of hard and soft wood -- 1/2 hour
a. List types of hardwood.
b. List types of soft wood
c. List advantages and disadvantages of each.

LESSON 7. Grains of wood -- 1/2 hour
a. List different types of grain.
b. List reasons for each type of grain.

LESSON 8. Sawing of logs -- 1/2 hour
a. Explain what is slash cut.
b. Explain what is quarter cut.

LESSON 9. Manufacturers' specification system of classification of lumber and grading system -- 1/2 hour
a. List criteria for classification of lumber.
b. List qualification for each grade.

LESSON 10. Classifying and computing lumber quality -- 1/2 hour
- a. Order lumber on basis of grading system.
- b. Use the manufacturer's classification systems for lumber.
- c. Computer lumber quality.

LESSON 11 Other wood fasteners -- 1/2 hour
- a. Use of joist hangers, rafter anchors, split ring and bolts.

B. WOOD ADHESIVES (1 hour) -- Ability to . . .

LESSON 1. Principles of wood adhesives -- 1/2 hour
- a. List principle behind wood adhesives.
- b. List use of wood adhesives.

LESSON 2. Use of wood adhesives -- 1/2 hour
- a. List strength of wood adhesives.
- b. Mix wood adhesives.
- c. Proper use and amount of wood adhesives.

C. PLYWOOD (4 hours) -- Ability to . . .

LESSON 1. Plywood selection -- 1 hour
- a. List the different classifications.
- b. List the different grades.
- c. List factors to consider in selection.

LESSON 2. Properties of plywood -- 1/2 hour
- a. List the characteristics of plywood.
- b. List the possible glues and their application.

LESSON 3. Processing of plywood -- 1 hour
- a. List means of manufacturing plywood.
- b. Grades of lumber used for plywood.
- c. Different types of wood used.
- d. Uniformity and quality of product.

LESSON 4. Plywood sizes and finishes -- 1/2 hour
- a. List possible sizes of plywood.
- b. List the finishes normally found.

LESSON 5. Common uses of plywood -- 1 hour
- a. List of industrial uses of plywood.
- b. List of agricultural uses of plywood.
- c. List of advantages and reasons for use of plywood.

D. BUILDING FRAMING (3 hours) -- Ability to . . .

LESSON 1. Using the framing square -- 1 hour
- a. The principle of a framing square as related to the right angle.

LESSON 2. Brace layout -- 1 hour
- a. Read the framing square table for a brace having equal rise and run.
- b. Discuss the fact that a brace with equal rise and run is a right triangle with the opposite two angles both being 45°.
- c. Use the square to make the seat and plumb cut.
- d. Explain braces needed in frame and pole type buildings.

LESSON 3. The essential features of framing a pole shed -- 1/2 hour
- a. Select pole style and size.
- b. List methods of attaching rafters to pole.

LESSON 4. Advantages and disadvantages of pole buildings -- 1/2 hour
- a. List the advantages and disadvantages of a pole building.
- b. Discuss economic advantages of pole buildings.

UNIT VII. RAFTER LAYOUT AND ROOF NOMENCLATURE COMPETENCIES

1. Understanding terminology of roof and framing square.
2. Layout the common, hip, jack, valley rafters with the framing square.
3. Understand principles of trusses.
4. Construct saw horse with the use of the framing square.
5. Select roof materials.

A. ROOFING (4 hours) -- Ability to . . .

LESSON 1. Types of base material and covering material -- 1 hour
- a. Recognize when to use asphalt shingles, asbestos shingles, galvanized metal, aluminum or tile.
- b. List different types and styles of each roofing material.
- c. List materials which can be used for walls.

LESSON 2. Application of materials and types of nails -- 1 hour
- a. Recognize proper techniques for applying roofing and siding.
- b. Distinguish roofing nails from lead heads and lengths to use.
- c. Apply roofing and siding.

LESSON 3. Building roof nomenclature -- 2 hours
- a. Define the terms span, run, rise, pitch, per foot of run, per given run, ridge board, plate and tail.
- b. Use the measuring line.
- c. Repair and upkeep of roofs.

B. RAFTERS AND TRUSSES (16 hours) -- Ability to . . .

LESSON 1. Common rafter layout -- 4 hours
- a. The uses of a common rafter.
- b. Determine the length of rafter.
- c. Measure out the length of rafter.
- d. Make plumb and seat cuts.
- e. Use rafter tables on the framing square.

LESSON 2. Use of the ridge board -- 1 hour
- a. Discuss when and why a ridge board is used.
- b. Measure length of rafter when a ridge board is used.

LESSON 3. Hip and valley rafter layout -- 2 hours
- a. List the uses of hip and valley rafters.
- b. Determine length of hip and valley rafters.
- c. Shorten rafter for ridge board and lengthen for side cut.

LESSON 4. Jack rafter -- 1 hour
- a. Discuss where jack rafters are used.
- b. List the three types of jack rafters.
- c. Measure jack rafters.
- d. Determine rafter length from the framing square.

LESSON 5. Roof types -- 2 hours
- a. Describe the different types of roofs.
- b. Discuss when different roof types would be used.
- c. Find run, rise and pitch of the different roof types.

LESSON 6. Truss design-- 1 hour
a. List the different types of trusses.
b. Draw the different types of trusses.
c. List different places trusses are utilized.

LESSON 7. Materials For Trusses and Rafters -- 1 hour
a. List of possible materials to be used.
b. Describe types of hardware used with rafters and trusses.

LESSON 8. Construction and layout -- 3 hours
a. Layout a model truss rafter.
b. Make proper joints.
c. Make a jig for constructing trusses and rafters.
d Test rafters and trusses for strength.

LESSON 9. Resource Person - Construction Procedures -- 1 hour
a. Observe slides from his company's construction procedurs.

UNIT VIII. BUILDING CONSTRUCTION PROCEDURES COMPETENCIES

1. Utilize material covered previously with the cooperation of local lumber yard or parents; construct class projects, i.e.

   a. hog houses
   b. storage sheds
   c. hay bunks
   d. feed bunks
   e. ect.

A. PROJECT CONSTRUCTION (40 hours)

UNIT IX. ENVIRONMENTAL CONTROL COMPETENCIES

1. Select appropriate insulation materials.
2. Determine amount of insulation needed.
3. Correctly install insulation material.
4. Understand need for vapor control.
5. Determine ventilation requirements, fans, air intakes, draft controls, etc.

A. ENVIRONMENTAL CONTROL (5 hours) -- Ability to . . .

LESSON 1. Insulation material and value -- 1 hour
   a. Explain "R" values.
   b. Explain "U" values.

LESSON 2 Vapor control -- 2 hours
   a. List barrier types.
   b. Outline barrier placement.

LESSON 3. Ventilation requirements -- 2 hours
   a. List fan types.
   b. Outline fan placement.
   c. Determine fan capacities.
   d. Sketch air intake types.
   e. Locate air intake placements.
   f. Describe automatic controls needed.

UNIT X. ELECTRICAL PRINCIPLES COMPETENCIES

1. Develop an understanding of the safe method of using electricity.
2. Understand how electricity is generated and distributed.
3. Understand electrical terminology.
4. To trace circuits.
5. Understand National Electrical code as it applies to the farm.
6. To trouble shoot common electrical problems.
7. To install simple additional wiring to pass inspection.

A. ELECTRIC PRINCIPLES (6 hours) -- Ability to . . .

LESSON 1. Becoming acquainted with electricity -- 1 hour
- a. Recognize how electricity is generated.
- b. Determine electrical applications on the farm.
- c. Calculate the cost of electricity.

LESSON 2. National electric code and safety -- 1 hour
- a. Discuss how to ground electrical systems.
- b. Recognize the importance of using only equipment approved by Underwriters Laboratories.
- c. Discuss the purpose and farm application of the National Electric Code.

LESSON 3. Electrical terms -- 1 hour
- a. Define the electrical units volts, amperes, watts, kilowatt hour, and ohm.
- b. A.C. and D.C. current.
- c. Define single and three phase current.
- d. Differentiate between series and parallel circuits.
- e. Measure electrical volts, amperes, ohms and watts.
- f. Trace an electrical circuit.

LESSON 4. Electrical terms -- 1 hour
- a. Watch demonstration on volts amps and watts on electrical board.
- b. Answer several problems on figuring watts given amps and volts, and figuring amps given watts and volts.

LESSON 5. Electrical safety devices and trouble shooting -- 1 hour
- a. Recognize the operation of fuses and circuit breakers.
- b. List the hazards of overfusing and tampering with safety devices.
- c. List the types of fuses, fusetrons, fusestats and circuit breaker devices.

LESSON 6. Electrical trouble-shooting -- 1 hour
- a. List the steps to follow in trouble shooting an electrical circuit.
- b. Discuss reasons for following the order used in trouble shooting an electrical circuit.

B. ELECTRICAL WIRING (6 hours) -- Ability to . . .

LESSON 1. Elementary wiring and circuit maintenance -- 1 hour
- a. Make the underwriter's knot and attach a can to a conductor.
- b. Discuss the basic types of service cords.
- c. Discuss the types of connectors (solder - solderless).

LESSON 2. Simple circuit -- 1 hour
- a. Wire a simple circuit including power source, fuse, switch, load and conductors (hot and neutral).
- b. Explain the function of each to the circuit.

LESSON 3. Repair of electrical wiring -- 1 hour
- a. The ability to replace an old service cord on a piece of equipment.
- b. Make an extension cord.

LESSON 4. Wiring a 240-circuit -- 1 hour
- a. Discuss the difference between a 240-circuit and a 120-circuit.
- b. Wire a 240-circuit.

LESSON 5. Wire size and type in relationship to length of circuit -- 1 hour
- a. List sizes of wire available.
- b. List recommended sizes of wire for different lengths of circuits.
- c. List different types of wire and where they are used.

LESSON 6. Wiring receptacals -- 1 hour
- a. Wire a 120 volt duplex receptical.
- b. Wire a 240 volt duplex receptical.
- c. Wire a receptical and outlet 120 volt and one outlet 240 volt.

UNIT XI. ELECTRICAL MOTORS AND CONTROLS COMPETENCIES

A. Understand motor terminology.
B. Select proper size and type of moter for the job.
C. To trace starting and running circuits.
D. To revise and wire for appropriate voltage operation.
E. To conduct routine maintenance procedures.
F. To conduct trouble shooting procedure.
G. Understand principles of overload protection devices.
H. To wire and trouble-shoot motor control devices. i.e. remote con't., thermostat, humidistat, photo-electric, relays, variable speeds.

I. MOTORS (6 hours) -- Ability to . . .

LESSON 1. How do electric motors start and run -- 1 hour
a. Discuss the purpose of permanent and electromagnets.
b. Discuss how an electro-magnetic stator and rotor are made into a simple motor.
c. Identify parts of induction run motors used on farms.
d. Discuss what makes an electric motor run.
e. Discuss how the following types of electric motors start and run; split-phase, capacitor start, series (Universal), repulsion start induction and shaded pole motors.

LESSON 2. General maintenance and motor service -- 1 hour
a. Discuss the conditions which reduce the effective life of a motor.
b. List when a motor needs service.
c. Adjust proper belt tension.
d. Do a continuity check.
e. Perform proper motor lubrication.
f. Check the quality of motor windings.

LESSON 3. Parts of an electric motor -- 1 hour
a. Identify parts of the motor.
b. Explain how an electric motor operates.
c. Reverse an electric motor.
d. Change an electric motor from 120 to 240 volts.

LESSON 4. Overload protection, starters and starting current requirements -- 1 hour.
a. Determine the difference between overload protection and circuit protection.
b. Identify overload protection devices.
c. Identify size of overload protection devices.
d. Discuss proper locating overload protection devices.
e. Discuss when motor starting devices are needed.
f. Differentiate between starting current vs. running current.

LESSON 5. Selection of electric motors for service intended -- 1 hour
a. List the different types of electric motors that are available for farm application.
b. Identify the different types of electric motors.
c. List the criteria for selecting motor for farm use on basis of bearings, mounts, motor types for load, exposure.

LESSON 6. Motor wiring, reversal and changing for different voltage -- 1 hour
a. Recognize the procedure for reversing different motor types (split phase, capacitor, repulsion induction, 3 phase).

II. ELECTRIC CONTROLS (9 hours) -- Ability to . . .

LESSON 1. Introduction to electrical controls and control circuits -- 2 hours.
a. Recognize how farms are automated.
b. List the purpose and function of control devices.
c. List the uses of non-automatic control devices.
d. List the uses of automatic control devices.
e. Define electrical control terms and symbols for schematic diagrams.
f. Make a diagram of a system which may be automated on the student's home farm.

LESSON 2. Switches and switch control circuits -- 1 hour
a. List and discuss the principles and operation of various switch types.
b. List and discuss the uses for tumbler or toggle switches, switches with built-in overload protection, limit switches, 3-way and 4-way switches.
c. Interpret switch control circuits.
d. Draw control circuit diagrams.

LESSON 3. Relay devices -- 1 hour
a. List and discuss the uses, components and operation of relay devices.
b. Determine ampere rating, voltage rating, size of load to be controlled by various relays.
c. List the types of relays - (SPST, SPDT, DPST, and time delay).
d. Diagram a system using relay switches.

LESSON 4. Motor control devices and automatic sensing devices -- 2 hours
a. List the purposes, types, components and rating of motor control devices.
b. Recognize types of control and sensing devices (manual controller, magnetic, timing, lighting, temperature and humidity).
c. Discuss the farm uses for control and sensing devices.
d. Diagram automatic sensing and motor control devices.

LESSON 5. Temperature controllers-- 1 hour
a. List the various types of thermostats and where each is used, both heating and cooling types.
b. Correctly wire up a thermostat so that it will function properly.

LESSON 6. Humidity controllers -- 1 hour
a. Discuss the purpose of, and types of humidistats.
b. Correctly wire a humidistat.

LESSON 7. Photoelectric controllers-- 1 hour
a. List the purpose and types of photo cells.
b. Wire a photo cell properly.

UNIT XII. PUMPS AND PLUMBING MATERIAL COMPETENCIES

A. How to determine water requirements.
B. Understand water terminology.
C. Select a pump to fit the well and water characteristics.
D. Understand the principles of air control on a water system.
E. Select plumbing material for safe water transmission.
F. Develop an awareness of water pollution problems and how to sample water for Health Department tests.
G. To identify plumbing fittings.
H. To plan a layout and estimate material for a simple plumbing exercise.
I. Joint plumbing materials by appropriate methods.

A. WATER SYSTEMS (10 hours) -- Ability to . . .

LESSON 1. Water capacity needs of the farm -- 2 hours
a. Figure total volume of water needed per day.
b. Find water needs per day for each livestock unit.
c. Find water needs per day for the household.

LESSON 2. Principles of water systems -- 1 hour
a. Discuss the use of gravity in water systems.
b. Discuss the use of pressure in water systems.
c. Discuss the use of vacuums in water systems.
d. Sketch the overall water systems.

LESSON 3. Well construction and location -- 1 hour
a. Identify ground water characteristics and location in relation to lay of the land.
b. List the different means of constructing wells.

LESSON 4. Types of water pumps -- 1 hour
a. List types of pumps available, their maximum capacities, cost of purchase, ease of installation, and types of casing needed.
b. Describe the difference between deep and shallow wells.

LESSON 5. Pressure tanks -- 1 hour
a. List types of tanks available, and capacity in pounds of pressure.
b. Calculate the size of tank needed for student's farm.

LESSON 6. Motors, switches, and valves -- 1 hour
a. List types of motors, switches, and valves needed in a water system
b. Discuss the needs of valves, switches, and motors in a water system

LESSON 7. Water purity standards -- 1 hour
a. List common problems encountered in a water system.
b. Perform the necessary maintenance functions in a water system.

LESSON 8. Water purity standards -- 1 hour
a. List the state water quality standards applicable to the home farm.
b. Discuss how these standards can be accomplished on the student's home farm.

LESSON 9. Types of livestock waterers and their maintenance -- 1 hour
- a. List the types of livestock waterers available.
- b. Discover the basic concepts behind livestock waterers.
- c. Perform maintenance functions on livestock waterers.

B. PLUMBING (8 hours) -- Ability to . . .

LESSON 1. The materials used in plumbing -- 1 hour
- a. List possible plumbing materials
- b. List tools used in plumbing.
- c. Use the plumbing tools.
- d. Discuss plumbing terms.

LESSON 2. The cutting of pipe -- 1/2 hour
- a. Discuss the cutting of pipe
- b. Cut pipe in the shop.
- c. Cut on different types of pipe.

LESSON 3. The cutting of threads -- 1/2 hour
- a. Discuss the cutting of threads.
- b. Cut threads in the shop on different pipes.
- c. Discuss the use and use cutting oil.

LESSON 4. The different pipe fittings -- 1 hour
- a. List the many types of fittings.
- b. Use some of the fitting in the shop.
- c. Solder pipe fittings.

LESSON 5. Measure and layout water lines -- 1 hour
- a. Discuss how to measure water lines.
- b. Observe how water lines are layed out.
- c. Determine size of line needs.

LESSON 6. Plumbing standards and with rigid and flexible regulations -- 1 hour
- a. List and discuss the regulations for plumbing.
- b. Identify parts, assemble units.

LESSON 7. Plumbing with plastic pipe -- 1 hour
- a. Discuss water system installation.
- b. Identify parts.
- c. Assemble units.

LESSON 8. Plumbing for disposal systems -- 1 hour
- a. Discuss plumbing for drains.
- b. Discuss and observe the use float system of bathroom stools.
- c. Observe the installation of plumbing to a septic tank.

LESSON 9. Safety in plumbing -- 1 hour
- a. Use tools properly.
- b. Work with electrical service under wet conditions.

UNIT XIII. WASTE DISPOSAL COMPETENCIES

A. Design plan for home farm disposal system meeting PCA standards.
B. Determine equipment requirements for different manure disposal systems.
C. Calculate pit capacities and time spans between cleaning.
D. Ability to seek professional advance from government agencies on waste disposal systems.

A. WASTE DISPOSAL (5 hours) -- Ability to . . .

LESSON 1. Types of farm disposal systems -- 1 hour
a. Draw present home farm disposal system.
b. Compare present disposal system with the recommended farm disposal system.

LESSON 2. Septic tanks -- 1 hour
a. Discuss the size needed.
b. Discuss proper location.
c. Discuss types and installation.

LESSON 3. Livestock manure removal -- 1 hour
a. List types of livestock manure removal.
b. Draw up cost comparisons for different manure disposal systems, and list equipment needed for each system.

LESSON 4. Construction, maintenance and problems encountered in manure pits -- 1 hour
a. Calculate the size of pit needed for a specific situation.
b. Figure out how often this pit must be cleaned and how to properly clean out the pit.
c. List the problems encountered in manure pits.

LESSON 5. Pollution regulations -- 1 hour
a. List local, state and federal regulations on manure disposal from farms.
b. Discuss future changes anticipated on pollution control regulations.

UNIT XIV MATERIALS HANDLING SYSTEM COMPETENCIES

A. To choose the most economical system for their enterprise.
B. To determine when the management decision for his size of operation dictates when he should purchase a materials handling system.
C. To describe the types and varieties of materials handling system that are available.
D. To do common repair work on materials handling systems.
E. To safely operate the equipment in materials handling.

I. CONVEYING SYSTEMS (10 hours) -- .bility to . . .

LESSON 1. Grain elevators -- 1 hour
a. Identify parts of grain elevators.
b. Discuss different power sources for elevators.

LESSON 2. Augers -- 1 hour
a. Identify parts of auger.
b. Compare auger size to grain's capacity.
c. List uses of the auger.

LESSON 3. Conveyers -- 1 hour
a. List uses of conveyers.
b. Discuss designs of conveyers for livestock feeding.

LESSON 4. Silo unloaders -- 1 hour
a. List parts of a silo unloader.
b. List common repair and maintenance of a silo unloader.

LESSON 5. Safety -- 1 hour
a. List the safety procedures to follow when working with elevators.
b. List places where safety shields are used on elevators.

LESSON 6. Grain bins and grain driers -- 2 hours
a. Describe systems visited on field trip's.
b. Economically analyze the different drying systems.

LESSON 7. Feed augers -- 1 hour
a. Describe when to use augers.
b. List safety precautions when using elevators.
c. List applications of wind pipes.

LESSON 8. Egg and dairy handling equipment -- 2 hours
a. List types of equipment available.
b. Describe types of equipment for specific operations.